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ABSTRACT

A shadowing paradigm was used to determine the extent to which subjects could comprehend a spoken message without allocating attention or awareness to it. The paradigm involved presenting subjects with a control passage describing neutral events and an experimental passage describing embarrassing events over an unattended auditory channel. Measurements were taken of the subjects' ability to shadow (repeat) a passage. Each subject's skin conductance was also recorded as a measure of his or her unconscious reaction to unattended passages. Results indicated that the experimental passage had an effect on the subjects as measured by skin conductance. The findings suggest that at some level the subjects knew that the experimental passage was more interesting than the control passage and thus were able to comprehend it at some level more inclusive than that of the individual word. (Time lines for the control and experimental conditions are appended, along with topics of the passages used in the study.) (FL)

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Comprehension of an Unattended Prose Passage

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ABSTRACT

The issue addressed is the extent to which a spoken message can be comprehended without allocating attention or awareness to the message. Past research shows that the meanings of single words can be comprehended outside of awareness. The question remains whether unconscious message analysis can proceed beyond the level of single words. Using a common set of lexical items, a control passage describing neutral events and an experimental passage describing embarrassing events were constructed. A shadowing paradigm was employed to present these messages over an unattended auditory channel while several conscious (e.g., shadowing performance) and unconscious (skin conductance) indices of message comprehension were monitored. Skin conductance, but none of the conscious indices, registered an effect of the embarrassing events passage. This indicates that unconscious comprehension can proceed beyond the lexical level.

My coauthors and I have been concerned with the following issue: What kinds of mental processes can proceed without attention? More specifically, what kinds of language comprehension can proceed without attention? A full answer to this question might help reveal the nature of comprehension processes.

Part of the answer to this question has been available for some time. It is generally agreed that we can comprehend the meanings of single words without being conscious of them. The best-known studies illustrating this are Lewis' (1970) demonstration that unattended words related to shadowed words affect the latency of shadowing, and Corteen and Wood's (1972) finding that shock-associated words produce a skin conductance (SC) response when presented on an unattended auditory channel.

But what about linguistic units beyond the word level? Can they be comprehended without attention? Most of us would probably answer no to this question, if for no other reason than comprehension seems to be a very complex affair.

In order to answer this question, we have done a series of shadowing studies of the form shown on the overhead (Fig 1): The two time lines represent when and what the subject hears in each ear, one attended, the other unattended. That variable was balanced. In the attended ear, the subject hears a continuous, recorded, moderately difficult prose passage. The subject is instructed to repeat or "shadow" the message. This shadowing task ostensibly occupies the subject's attention fully.

In the unattended ear, first is a period of silence. This gives the subject an opportunity to become proficient at shadowing. Next come two adapting passages. These are similar to experimental and control passages in their physical nature and give subjects some practice at ignoring the unattended message.

Next are experimental and control passages. The order of these is counterbalanced. The experimental passage is designed to be interesting or arousing. The control passage is identical to the experimental passage in specific ways, but is designed to be less interesting.

In our experiments the attended message is presented in a female voice and the unattended message is a male voice. Recording the message in voices of different qualities minimizes the difficulty in ignoring one message. Under these general conditions outlined here, it is expected that the unattended passage will not be consciously heard or processed.

As the subject shadows, skin conductance (SC) is recorded and examined for reactions to the unattended passages. If reactions to experimental and control passages differs this indicates that the unattended messages were consciously or unconsciously comprehended.

The experimental and control passages can consist of a variety of materials. In one of our experiments, the experimental passage consisted of a set of embarrassing incidents, empirically derived by asking undergraduates what embarrasses them. First, we generated 32 descriptions of potentially embarrassing episodes, then submitted them to undergraduates who rated their embarrassment value. We chose the seven most embarrassing ($\overline{X}$ = 7.2 on a 9-point scale) episodes, which, along with transition sentences, formed our experimental passage (see Table 1). We then constructed the control passage using the same general episodic structure and using the same words but describing innocuous episodes (see Table 1). Thus the experimental and control passages differed only at levels higher than the individual lexical item, and any differences in subjects' reactions to these two passages must be due to comprehension of these higher levels.

Two adapting passages of the same general length and episodic structure were also constructed. These, along with the passages described above, were the materials used in the experimental paradigm described earlier. Forty-four Introductory Psychology students volunteered to participate in partial fulfillment of an out-of-class participation requirement.

Table 2 shows the dependent variables that were investigated, divided into those that index conscious (supraliminal) comprehension of the unattended message, and the one of primary interest to us which appears to index subliminal comprehension. Also shown are the results of statistical contrasts between the experimental and control passages.

First, consider the supraliminal indicators. Any difference between experimental and control conditions on these measures indicates subjects did not succeed in ignoring the unattended message and thus would tend to invalidate the experiment. Conversely, absence of differences indicates subjects were successful in following instructions to ignore that message. On none of these indicators was there a significant difference between passages, so there are strong reasons for assuming subjects did not consciously hear the messages. The indicators are discussed individually below.

RECALL-- at the end of the experiment, subjects were carefully asked, in several different ways, what they could remember of the unattended passage. Recall levels were too low to warrant a formal analysis of this data. None of the subjects were aware of the general nature of the experimental passage. Usually a subject could recall one or two words, and had the impression that they had heard more than they could recall at the end of the experiment, but of course we couldn't tell which passage an isolated word or two was being recalled from, so we couldn't apply a statistical analysis.

AWARENESS RESPONSES-- before the experiment began, subjects were given a hand-held response button and were asked to press it any time they accidentally heard the the unattended message. This was a second way of assessing whether the unattended message was really unattended. If subjects consciously recognized the nature of the experimental passage, many more responses should occur during it. By a sign test, there were no more button presses during the experimental than during the control passage.

SHADOWING PERFORMANCE-- if subjects stop shadowing the attended passage, for whatever reason, they are likely to hear the unattended passage. We kept a record of the number of seconds subjects stopped shadowing during experimental and control passages. Again, if subjects consciously recognized the nature of the experimental passage, shadowing would likely be disrupted. We found no evidence of that.

SCR-- this is a phasic, increase then decrease, in skin conductance. It is generally taken as an index of emotionality. We categorize it as a supraliminal index because in similar studies, subjects have shown SCRs only when attending to the experimental passage. For each subject in each condition, we analyzed:

1. the total number of SCRs
2. the mean SCR
3. the standard deviation
4. the largest SCR

On none of these measures was there a difference between control and experimental passages.

Thus far the results indicate that subjects were indeed not aware of the unattended message--a limited result. I have spent so much time on that point because one of the most serious criticisms of this kind of experiment is the possibility that subjects are in fact aware of the ostensibly "unattended" message,

either by switching their attention to it occasionally, or by some other means. The results discussed above clearly rule out that artifact.

Turning to the variable of primary interest:

SC-- this is the variable we expected to index unconscious comprehension. SC includes any overall increases or decreases in skin conductance. Higher levels of SC are generally taken as indications of increased cognitive effort (Kilpatrick, 1972), for instance, the extra effort needed to tune out or ignore an interesting message. We classify this as a subliminal measure of comprehension, because although subjects may be aware of the extra effort needed to shadow during the experimental passage, this does not imply that they are aware of the unattended passage itself.

For control and experimental passages, we sampled the value of SC every 5 sec, relative to its value at the beginning of the passage. The average graphs of SC are shown in figure 2.

As would be expected if our subjects had to increase their level of effort in order to ignore an interesting message, SC increases and remains higher for the experimental passage. The increase appears localized in the first minute. For each subject we calculated the slope of control and experimental data for the first minute. Using a Randomized Block ANOVA, slopes for control and experimental passages were found to differ beyond chance (see Table 2).

These results indicate that the experimental passage had an effect on the subjects, although not a conscious one. Apparently the experimental passage requires more effort to be successfully ignored. This in turn means that, at some level, the subject knows that this passage is more interesting or arousing than the control. In order to know this, the subjects must have comprehended

the passage at some level more inclusive than the individual word, although from this data, it isn't clear what the upper limit is.

How can we comprehend clauses or sentences or whole episodes without attending to them? One possibility is that speech comprehension is automatized. Perhaps we have listened to so much speech during our lives that comprehension processes have become automated. Like driving or any other highly practiced skill, we can do quite alot of it while attending to something else. This implies that we possess a set of simple routines which can analyze sentence structure. These routines must integrate that structure with word meanings to get an interpretation of a sentence. Sometimes they must make decisions among alternative possibilities. And they must do all of this in a purely mechanical fashion. If this notion is correct, it should put some limits on reasonable proposals for comprehension strategies and processes.

References

Corteen, R. S., & Wood, B. Autonomic responses to shock-associated words in an unattended auditory channel. Journal of Experimental Psychology, 1972, 94, 975-979.

Kilpatrick, D. G. Differential responsiveness of two electrodermal indices to psychological stress and performance of a complex cognitive task. Psychophysiology, 1972, 9, 218-226.

Lewis, J. L. Semantic processing of unattended messages using dichotic listening. Journal of Experimental Psychology, 1970, 85, 225-228.

Unattended Prose Passage
UNATTENDED
EAR (R or L)
silent (4 min)
adapting
Prose (shadowed)
ATTENDED
EAR (L or R)
TIME

11

Fig. 1

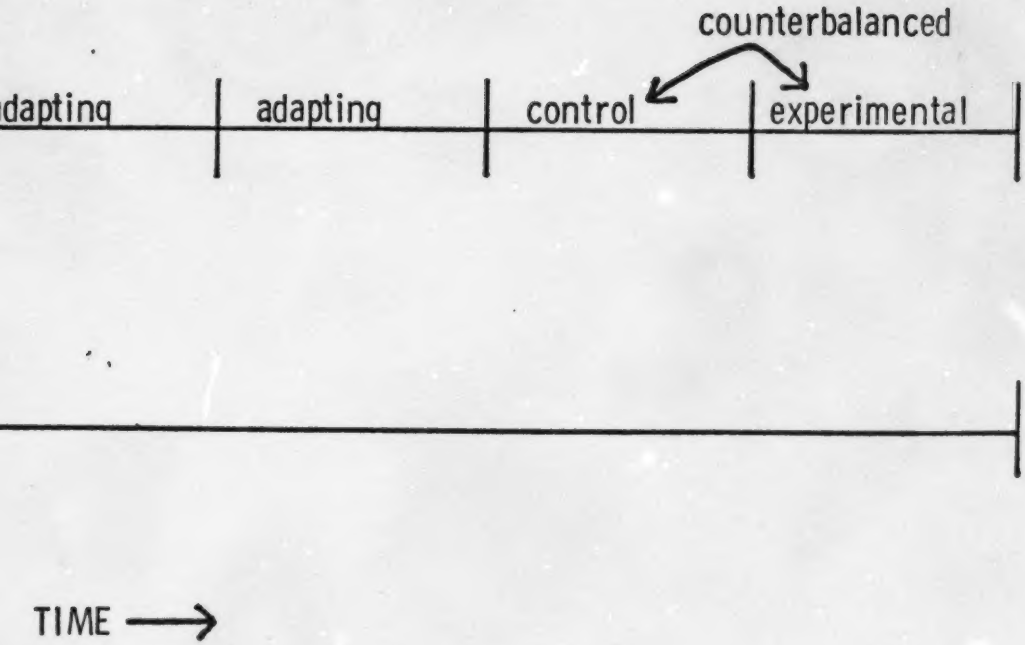
counterbalanced
dapting
adapting
control
experimental
TIME

Table 1

Experimental Passage:

You fall in front of a class

Spilling your tray in the dining hall

Exposed cheating on a test

You are publicly intoxicated

Open fly during a class report

Street nudity during sleep walking

Parents discover you and date in bed

- - - - - -

General characterization: public proscribed behaviors

Control Passage:

You greet a friend in class

Running out of food in the dining hall

Catching your scarf on your jeans

Giving a class report

You dream you walk down the street

Forgetting to lock a door

Others are intoxicated

- - - - - - -

General characterization: vague events not worth reporting

Table 2.

Dependent Variables

Supraliminal indicators (all tests are 1-tailed)

RECALL	no statistical analysis
AWARENESS RESPONSES	$z=1.54$, $p>.05$
SHADOWING PERFORMANCE	$t(43)=0.51$, $p>.05$
SCR	
number	$z=0.57$, $p>.05$
mean	$t(43)=1.39$, $p>.05$
SD	$t(43)=1.28$, $p>.05$
largest	$t(43)=1.63$, $p>.05$

Subliminal indicator:

SC	$F(43)=7.47$, $p<.01$

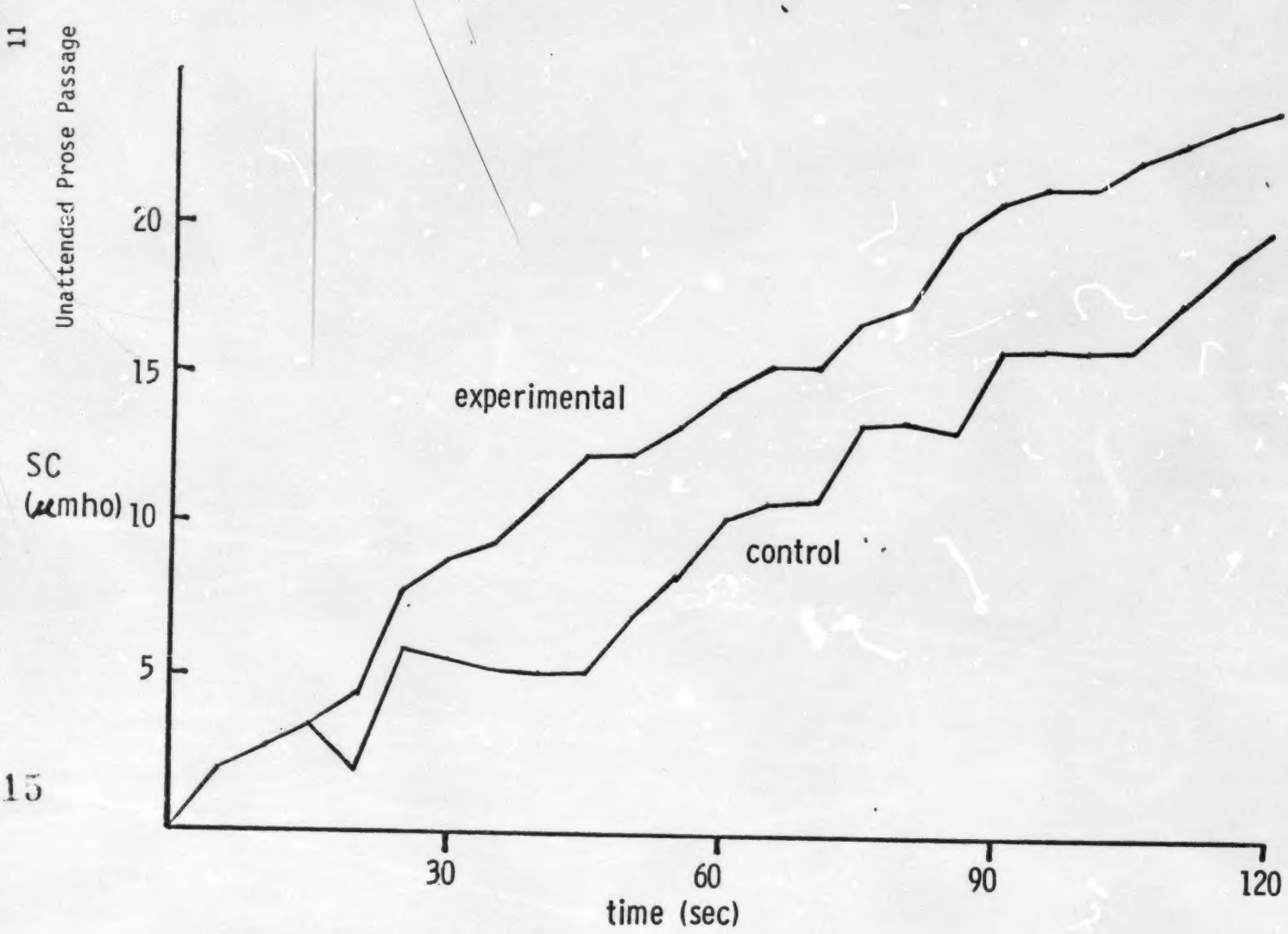
Unattended Prose Passage
SC
(μmho)
20
15
10
5
experimental
control
30
60
90
120
time (sec)

Fig. 2